



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN THE APPLICATION OF:

ROGER MOONS

CASE AD6883USNA  
NO.:

APPLICATION NO.: 10/627902

GROUP ART UNIT: 1761

FILED: JULY 25, 2003

EXAMINER: DREW E. BECKER  
CONFIRMATION NO.: 3469

FOR: IMPROVED THERMOPLASTIC POLYMERIC OVENWARE

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**DECLARATION UNDER 37 C.F.R. 1.132**

1. I obtained a B.S. in Chemistry from the Polytechnic Institute of Brooklyn in 1962 and a Ph.D. in Organic Chemistry from the University of California at Davis in 1967.

2. I am currently receiving a pension from the assignee of this application E.I. DuPont de Nemours & Co., Inc. (hereinafter DuPont).

3. I am a Registered Patent Agent (No. 33,852).

4. I am currently a consultant for DuPont on technical and patent matters.

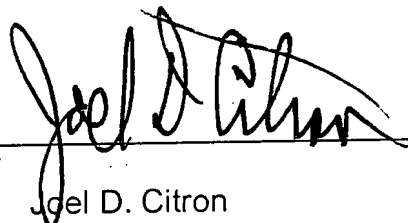
5. While consulting for DuPont I directed an experiment as set forth below.

6. A composition containing 55 weight percent of Zenite® 6000 Liquid Crystalline Polymer (available from E. I. DuPont de Nemours & Co., Inc., Wilmington, DE 19998 USA), 37 weight percent talc, and 8 weight percent carbon fiber was prepared by melt mixing in a 30 mm Werner & Pfleiderer twin screw extruder. The techniques used to prepare this composition were similar to those commonly used to prepare other compositions containing LCPs.

7. The above composition was molded in a 6 oz. HPM injection molding machine into 4 inch diameter disks.

8. An above described disk (after machining) was tested for through plane thermal conductivity. The resulting value was  $0.368 \text{ W/m}^{\circ}\text{K}$ .

9. The attached pages from Electronic Research Notebooks D100052 and D100008 describe this experiment and the conditions used for the various operations. The sample number for the above described composition was 13-1. The composition of sample 13-2 has been blanked out from the page, and the results for the thermal conductivity of this sample have been omitted.

  
Joel D. Citron

Date: Mar 2, 2007



# DuPont Electronic Laboratory Notebook

Identification Number : D100052-28.01

Experiment Name : D100052-13

Program Name : Zenite

Project Name:Thermoconductivity for Joel Citron

Document Name : D100052-13 series Thermal Conductive Zenite Joel Citron.pdf

Site Name : EXP ST

Business Unit :Engineering Polymers

Author Name : Mike J. Molitor

Date : 02/26/2007 14:59:57

Co-Author Details :

Witness Name : Adcock, Dave

Date : 02/26/2007 15:03:04

Date (GMT)	Signed by
2/26/2007 07:59:57 PM	Name: Mike J. Molitor Pre-Sig Hash: 9b9c723fedbb8ec913753be9ae4abc415c4f0fa1
Justification	By entering your password you verify that you planned and/or executed the work, directed the work, analyzed the result, or drew the conclusions described within this document.

2/26/2007 08:03:05 PM	Name: Adcock, Dave Pre-Sig Hash: 4004778267dalf14aed9d10dd217ba30817d5b91
Justification	By entering your password you will be signing to say that you have witnessed the information contained in this document

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	Pre-Sig Hash:
Justification	

	Name:
	Pre-Sig Hash:
Justification	

	Name:
	Pre-Sig Hash:
Justification	

	Name:
	Pre-Sig Hash:
Justification	

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E.I. du Pont de Nemours and Company

Sample # D100052  
Zenite 6000  
Jetfil Talc 575C  
Carbon fiber Sigrafil

13-1  
55  
37  
8

13-2

66

E. I. du Pont de Nemours and Company

TITLE 50-C DATE 10/1/66 E 110149-77

PURPOSE Comp

J.R.N. 2006-276 DATE 10/1/66 TECHNICIAN W. J. R. R. R. GREEN NOTEBOOK PGS

RESEARCHER M. J. R. R. R. NOTEBOOK PGS E-110149-13

BARREL 2-6 SCREW 2-6 SCREENS 2-6

DIE 1" SIZE 2 1/4 ADAPTERS 2-6 CHARGE CODE

POLYMER Zenite 6000 INTERLOCKS CHECKED ✓ RUN STARTED/COMPLETED

AUXILIARY EQUIPMENT USED QUENCH TEST RACK - CHANGE TO 3000 FEEDER 325/100

SAMPLE #	TIME	SET PTS	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL
BARREL 2	370	370	370						
BARREL 3	370	370	370						
BARREL 4	370	370	370						
BARREL 5	370	370	370						
BARREL 6	370	370	370						
BARREL 7	370	370	370						
BARREL 8	370	370	370						
BARREL 9	370	370	370						
BARREL 10	370	370	370						
BARREL 11	370	370	370						
BARREL 12	370	370	370						
BARREL 13	370	370	370						
DIE	370	370	370						
ADAPTER	370	370	370						
SCREW SPEED	370	370	370						
TORQUE	370	370	370						
DIE PRESS	370	370	370						
VACUUM	370	370	370						
DCA	370	370	370						
DCV	370	370	370						
FEED 1 PPH	370	370	370						
FEED 2 PPH	370	370	370						
FEED 3 PPH	370	370	370						
PUMP GPH	370	370	370						
RATE (PPH)	370	370	370						
PANEL MELT	370	370	370						
HAND MELT	370	370	370						
CUTTER SPD	370	370	370						

COMMENTS

EXPERIMENTED Cham R. R. R. DATE 10/1/66

TESTED BY Stephen R. R. R. DATE 10-31-66

57 m. diff.

BOOK PAGE E. I. du Pont de Nemours and Company

TITLE 602 A INJECTION MOLDING DATE 10-30-66

E 111563-36 PURPOSE PHYSICAL TESTING

J.R. NO. 1375 NB NO. D 100052 DATE 10-30-66 CYLINDER 602 A

FOR ASTM CHARGE/SBU E. I. RAM SPEED RAM

POLYMER TYPE Zenite SCREW G. I. SCREW SPEED -

MOLD 6" DIA (E-7) NOZZLE 1/2" BACK PRESS 1000

SAMPLE NO.	REAR	CENTER	FRONT	NOZZLE	MOLD TEMP		CYCLE		PRESS.		MELT	J.M. RAM
					A	B	B	I	H	BOOST		
13-2	325	352	332	323	100	100	2	15	15	300	250	362





# DuPont Electronic Laboratory Notebook

Identification Number : D100008 32.02

Experiment Name : D100008-18

Program Name : Zenite

Project Name: Thermal Conductivity

Document Name : ThermalConductivityofD100052-13-1and13-2.pdf

Site Name : EXP ST

Business Unit :Engineering Polymers

Author Name : Adcock, Dave

Date : 02/26/2007 12:57:03

Co-Author Details :

Witness Name : Harvey, Pat A.

Date : 02/26/2007 13:07:04

Date (GMT)	Signed By
2/26/2007 05:57:03 PM	Name: Adcock, Dave
	File-Sig Hash: 0a980b52019133010a9eb/b420130a0b935/13794
Justification	By entering your password you verify that you planned and/or executed the work, directed the work, analyzed the result, or draw the conclusions described within this document.

2/26/2007 06:07:04 PM	Name: Harvey, Pat A.
	Pre-Sig Hash: 73b0cadeclbdebf8234bdc64d81ae2e301af81ba
Justification	By entering your password you will be signing to say that you have witnessed the information contained in this document

	Name:
	Pre-Sig Hash:
Justification	

	Name:
	Pre-Sig Hash:
Justification	

	Name:
	Pre-Sig Hash:
Justification	

	Name:
	Pre-Sig Hash:
Justification	

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USING TEST FILE : 13-1.tst  
DATE : 11/01/06

TEST DESCRIPTION

3100552-13-1

injection molded disc

SAMPLE ID : 13-1

SAMPLE THICKNESS: 3.030mm

Average sample temperature = 50 C Controller= 30 C

TU (C)	TG (C)	TL (C)	TH (C)	TU-TL (C)	Q	RATIO
50.0	48.2	40.4	30.0	19.64	9472.1	0.211266
60.8	48.0	40.8	29.5	19.75	10096.7	0.195657
60.6	48.1	40.9	29.5	19.73	10107.1	0.195156

Average sample temperature = 75 C Controller= 55 C

TU (C)	TG (C)	TL (C)	TH (C)	TU-TL (C)	Q	RATIO
78.1	65.9	58.4	49.3	19.74	8854.4	0.233231
85.2	72.0	65.6	54.7	19.68	10161.7	0.193207
85.2	72.0	65.6	54.7	19.62	10167.3	0.193013

USING CALIBRATION FILE: ESI04200.cal  
USING TEST FILE : 13-1.tst

USING FIRST ORDER FIT

SAMPLE ID : 13-1  
SAMPLE THICKNESS : 3.030mm  
CTE : 0.000e+000

THE SAMPLE HAS A THERMAL CONDUCTIVITY OF: 3.651347e-001 W/mK  
AND A THERMAL RESISTANCE OF : 8.298308e-003 m2K/W  
AT A TEMPERATURE OF : 50.78 C

0.365 W/mK

THE DELTA T THROUGH THE SAMPLE IS : 19.73 C  
THE HEATER TEMPERATURE IS : 29.54 C  
THE DELTA T ACROSS THE STACK IS : 31.10 C  
THE GUARD TEMPERATURE IS : 48.10 C

THE SAMPLE HAS A THERMAL CONDUCTIVITY OF: 3.702624e-001 W/mK  
AND A THERMAL RESISTANCE OF : 8.183385e-003 m2K/W  
AT A TEMPERATURE OF : 75.40 C

0.370 W/mK

THE DELTA T THROUGH THE SAMPLE IS : 19.62 C  
THE HEATER TEMPERATURE IS : 54.66 C  
THE DELTA T ACROSS THE STACK IS : 30.55 C  
THE GUARD TEMPERATURE IS : 72.02 C



# DuPont Electronic Laboratory Notebook

Identification Number : D100052-28.01

Experiment Name : D100052-13

Program Name : Zenite

Project Name:Thermoconductivity for Joel Citron

Document Name : D100052-13 series Thermal Conductive Zenite Joel Citron.pdf

Site Name : EXP ST

Business Unit :Engineering Polymers

Author Name : Mike J. Molitor

Date : 02/26/2007 14:59:57

Co-Author Details :

Witness Name : Adcock, Dave

Date : 02/26/2007 15:03:04

<b>Date (GMT)</b>	<b>Signed by</b>
2/26/2007 07:59:57 PM	Name: Mike J. Molitor
	Pre-Sig Hash: 9b9c723fedbb8ec913753be9ae4abc415c4f0fal
<b>Justification</b>	By entering your password you verify that you planned and/or executed the work, directed the work, analyzed the result, or drew the conclusions described within this document.

2/26/2007 08:03:05 PM	Name: Adcock, Dave
	Pre-Sig Hash: 4004778267dalf14aed9d10dd217ba30817d5b91
<b>Justification</b>	By entering your password you will be signing to say that you have witnessed the information contained in this document

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	Pre-Sig Hash:
<b>Justification</b>	

	Name:
	Pre-Sig Hash:
<b>Justification</b>	

	Name:
	Pre-Sig Hash:
<b>Justification</b>	

	Name:
	Pre-Sig Hash:
<b>Justification</b>	

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E.I. du Pont de Nemours and Company



Sample # D100052  
Zenite 6000  
Jetfil Talc 575C  
Carbon fiber Sigrafil

13-1  
55  
37  
8

13-2

66

E. I. du Pont de Nemours and Company

DATE 10/1/66

CHARGE CODE 110149-77

RESEARCHER M. J. J. 10/1/66

NOTEBOOK PG. E-21617-13

BARREL 2-2

SCREW 1/4

DIE 1/4

POLYMER 25000/15000

ADAPTERS 25000-50000-15000

INTERLOCKS CHECKED

RUN STARTED/COMPLETED

AUXILIARY EQUIPMENT USED

QUENCHER 25000-50000-15000

CHARGE TO 25000-50000-15000

FEEDER 25000-50000-15000

SAMPLE #	TIME	SET PTS	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL
BARREL 2	306	314	322						
BARREL 3	300	309	309						
BARREL 4	300	309	309						
BARREL 5	300	309	309						
BARREL 6	300	309	309						
BARREL 7	300	309	309						
BARREL 8	300	309	309						
BARREL 9	300	309	309						
BARREL 10	300	309	309						
BARREL 11	300	309	309						
BARREL 12	300	309	309						
BARREL 13	300	309	309						
DIE	300	309	309						
ADAPTER	300	309	309						
SCREW SPEED	300	309	309						
TORQUE	300	309	309						
DIE PRESS	300	309	309						
VACUUM	300	309	309						
DCA	300	309	309						
DCV	300	309	309						
FEED 1 PPH	300	309	309						
FEED 2 PPH	300	309	309						
FEED 3 PPH	300	309	309						
PUMP GPH	300	309	309						
RATE (PPH)	300	309	309						
BARREL MELT	300	309	309						
HAND MELT	300	309	309						
CUTTER SPD	300	309	309						

COMMENTS

EXPERIMENTER *Cham R. R.*

DATE 10/1/66

REVIEWED BY *Stephen R. Rethell*

DATE 10-31-66

57 m.h. diff.

BOOK PAGE

E. I. du Pont de Nemours and Company

TITLE 6 OZ. A INJECTION MOLDING

DATE 10-30-66

E 111563-36

PLANT/PGC PHYSICAL TESTING

JR NO 1175 NB NO D 100052

DATE 10-30-66

CYLINDER 6 OZ. A

FOR ANALYSIS

CHARGE/SSU E. I.

RAM SPEED 3417

POLYMER TYPE ZENITE

SCREW G. A.

SCREW SPEED

MOLD 1/2 OZ. (E-7)

NOZZLE 1/2 OZ.

BACK PRESS 1100

SAMPLE NO.	REAR	CENTER	FRONT	NOZZLE	MOLD TEMP		CYCLE			PRESS BOOST	PRESS INJ	MELT	SURF. KAN
					A	B	B	I	H				
13-2	325	332	332	323	100	100	2	15	15	350	250		363

[illegible]



# DuPont Electronic Laboratory Notebook

Identification Number : D100052-28.01

Experiment Name : D100052-13

Program Name : Zenite

Project Name:Thermoconductivity for Joel Citron

Document Name : D100052-13 series Thermal Conductive Zenite Joel Citron.pdf

Site Name : EXP ST

Business Unit :Engineering Polymers

Author Name : Mike J. Molitor

Date : 02/26/2007 14:59:57

Co-Author Details :

Witness Name : Adcock, Dave

Date : 02/26/2007 15:03:04

Date (GMT)	Signed by
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Justification	

	Name:
	Pre-Sig Hash:
Justification	

	Name:
	Pre-Sig Hash:
Justification	

	Name:
	Pre-Sig Hash:
Justification	

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E.I. du Pont de Nemours and Company

Sample # D100052      13-1      13-2  
 Zenite 6000      55  
 Jetfil Talc 575C      37  
 Carbon fiber Sigrafil      8

Lab

E. I. du Pont de Nemours and Company

TITLE 30-C DATE 10/17/06 E 110149-77

PURPOSE Comp

J.R.N. 2006-210 DATE 10/17/06 TECHNICIAN AREA NOTEBOOKS AREA  
 RESEARCHER M.J. 10/17/06 NOTEBOOKING E-210149-77  
 BARREL 20-C SCREW SCREENS  
 DIE 1" SIZE 7/8 ADAPTERS SPSY-SPRHS-FLC-13  
 POLYMER Zenite 6000 CHARGE CODE 10-31-06  
 INTERLOCKS CHECKED YES RUN STARTED/COMPLETED YES

AUXILIARY EQUIPMENT USED QUENCH SYSTEM CHANGE TO  
5.2" FEEDER 200/100

SAMPLE #	TIME	SET PTS	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL
BARREL 2	340	374	322						
BARREL 3	320	309	309						
BARREL 4	320	309	309						
BARREL 5	320	309	309						
BARREL 6	320	309	309						
BARREL 7	320	309	309						
BARREL 8	320	309	309						
BARREL 9	320	309	309						
BARREL 10	320	309	309						
BARREL 11	320	309	309						
BARREL 12	320	309	309						
BARREL 13	320	309	309						
DIE	320	309	309						
ADAPTER	320	309	309						
SCREW SPEED	320	309	309						
FEED RATE	320	309	309						
DIE PRESS	320	309	309						
VACUUM	320	309	309						
DCA	320	309	309						
DCV	320	309	309						
FEED 1 PPH	320	309	309						
FEED 2 PPH	320	309	309						
FEED 3 PPH	320	309	309						
PUMP DPH	320	309	309						
RATE (PPH)	320	309	309						
PANEL MELT	320	309	309						
HAND MELT	320	309	309						
CUTTER SPD	320	309	309						

COMMENTS

EXPERIMENTER Stephen R. Rethell DATE 10/17/06  
 ESTABLISHED BY Stephen R. Rethell DATE 10-31-06

57 m/h Diff.

BOOK PAGE E. I. du Pont de Nemours and Company

TITLE 6 OR A INJECTION MOLDING DATE 10-30-06

E 111563-36 PURPOSE PHYSICAL TESTING

JR NO. 1275 NB NO. D 100052 DATE 10-30-06 CYLINDER 6 OR A  
 FOR MULTI CHARGE/BBU E. I. RAM SPEED FAST  
 POLYMER TYPE ZENITE SCREW 6.1 SCREW SPEED -  
 MOLD 6.1" (E-T) NOZZLE 6.1" BACK PRESS 100

SAMPLE NO.	REAR	CENTER	FRONT	NOZZLE	MOLD TEMP		CYCLE	PRESS	MELT	SUCK		
					A	B						
13-2	325	332	332	323	100	100	2	15	15	350	250	360





# DuPont Electronic Laboratory Notebook

Identification Number : D100008 32.02

Experiment Name : D100008-18

Program Name : Zenite

Project Name: Thermal Conductivity

Document Name : ThermalConductivityofD100052-13-1and13-2.pdf

Site Name : EXP ST

Business Unit : Engineering Polymers

Author Name : Adcock, Dave

Date : 02/26/2007 12:57:03

Co-Author Details :

Witness Name : Harvey, Pat A.

Date : 02/26/2007 13:07:04

Date (GMT)	Signed by
2/26/2007 05:57:03 PM	Name: Adcock, Dave
	Pre-Sig Hash: 0a7604b2d19133610a9461b42e1360a693613794
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2/26/2007 06:07:04 PM	Name: Harvey, Pat A.
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Justification	

	Name:
	Pre-Sig Hash:
Justification	

	Name:
	Pre-Sig Hash:
Justification	

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E.I. du Pont de Nemours and Company

USING TEST FILE : 13-1.tst  
DATE : 11/01/06

TEST DESCRIPTION

3100052-13-1

Injection molded disc

SAMPLE ID : 13-1

SAMPLE THICKNESS: 3.030mm

Average sample temperature = 50 C Controller= 30 C

TU (C)	TG (C)	TL (C)	TH (C)	TU-TL (C)	Q	RATIO
50.0	48.2	40.4	30.0	19.64	9472.1	0.211266
60.6	48.0	40.8	29.5	19.75	10096.7	0.195657
60.6	48.1	40.9	29.5	19.73	10107.1	0.195166

Average sample temperature = 75 C Controller= 55 C

TU (C)	TG (C)	TL (C)	TH (C)	TU-TL (C)	Q	RATIO
78.1	65.9	58.4	49.3	19.74	8854.4	0.233231
85.2	72.0	65.6	54.7	19.63	10161.7	0.193207
85.2	72.0	65.6	54.7	19.62	10167.3	0.193013

USING CALIBRATION FILE: ESL04200.cal  
USING TEST FILE : 13-1.tst

USING FIRST ORDER FIT

SAMPLE ID : 13-1  
SAMPLE THICKNESS : 3.030mm  
CTE : 0.000e+000

THE SAMPLE HAS A THERMAL CONDUCTIVITY OF:  $3.651347e-001$  W/mK  
AND A THERMAL RESISTANCE OF:  $8.298308e-003$  m<sup>2</sup>K/W  
AT A TEMPERATURE OF: 50.78 C

0.365 W/mK

THE DELTA T THROUGH THE SAMPLE IS : 19.79 C  
THE HEATER TEMPERATURE IS : 29.54 C  
THE DELTA T ACROSS THE STACK IS : 31.10 C  
THE GUARD TEMPERATURE IS : 48.10 C

THE SAMPLE HAS A THERMAL CONDUCTIVITY OF:  $3.702624e-001$  W/mK  
AND A THERMAL RESISTANCE OF:  $8.183385e-003$  m<sup>2</sup>K/W  
AT A TEMPERATURE OF: 75.40 C

0.370 W/mK

THE DELTA T THROUGH THE SAMPLE IS : 19.62 C  
THE HEATER TEMPERATURE IS : 54.65 C  
THE DELTA T ACROSS THE STACK IS : 30.55 C  
THE GUARD TEMPERATURE IS : 72.02 C



# DuPont Electronic Laboratory Notebook

Identification Number : D100008 32.02

Experiment Name : D100008-18

Program Name : Zenite

Project Name: Thermal Conductivity

Document Name : ThermalConductivityofD100052-13-1and13-2.pdf

Site Name : EXP ST

Business Unit : Engineering Polymers

Author Name : Adcock, Dave

Date : 02/26/2007 12:57:03

Co-Author Details :

Witness Name : Harvey, Pat A.

Date : 02/26/2007 13:07:04

Date (GMT)	Signed by
2/26/2007 05:57:03 PM	Name: Adcock, Dave
	File-Sig Hash: 0a700402d1313301c074b1042e130d0b750613792
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Justification	

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USING TEST FILE : 13-1.tst  
DATE : 11/01/06

TEST DESCRIPTION

3100052-13-1

Injection molded disc

SAMPLE ID : 13-1  
SAMPLE THICKNESS: 3.030mm

Average sample temperature = 50 C Controller= 30 C

TU (C)	TG (C)	TL (C)	TH (C)	TU-TL (C)	Q	RATIO
50.0	48.2	40.4	30.0	19.64	9472.1	0.211266
60.6	48.0	40.8	29.5	19.75	10096.7	0.195657
60.6	48.1	40.9	29.5	19.73	10107.1	0.195166

Average sample temperature = 75 C Controller= 55 C

TU (C)	TG (C)	TL (C)	TH (C)	TU-TL (C)	Q	RATIO
78.1	65.9	58.4	49.3	19.74	8854.4	0.233231
85.2	72.0	65.6	54.7	19.63	10161.7	0.193207
85.2	72.0	65.6	54.7	19.62	10167.3	0.193013

USING CALIBRATION FILE: ESL04200.cal  
USING TEST FILE : 13-1.tst

USING FIRST ORDER FIT

SAMPLE ID : 13-1  
SAMPLE THICKNESS : 3.030mm  
CTE : 0.000e+000

THE SAMPLE HAS A THERMAL CONDUCTIVITY OF: 3.651347e-001 W/mK  
AND A THERMAL RESISTANCE OF : 8.298308e-003 m2K/W  
AT A TEMPERATURE OF : 50.78 C

0.365 W/mK

THE DELTA T THROUGH THE SAMPLE IS : 19.79 C  
THE HEATER TEMPERATURE IS : 29.54 C  
THE DELTA T ACROSS THE STACK IS : 31.10 C  
THE GUARD TEMPERATURE IS : 48.10 C

THE SAMPLE HAS A THERMAL CONDUCTIVITY OF: 3.702624e-001 W/mK  
AND A THERMAL RESISTANCE OF : 8.183385e-003 m2K/W  
AT A TEMPERATURE OF : 75.40 C

0.370 W/mK

THE DELTA T THROUGH THE SAMPLE IS : 19.62 C  
THE HEATER TEMPERATURE IS : 54.66 C  
THE DELTA T ACROSS THE STACK IS : 30.55 C  
THE GUARD TEMPERATURE IS : 72.02 C